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ScienceDirect

Procedia Engineering 176 (2017) 291 – 295

Procedia Engineering

www.elsevier.com/locate/procedia

Dynamics and Vibroacoustics of Machines (DVM2016)

Analysis of acoustic oscillations dependence on the process parameters in laser treatment

Veliev David, Israphilov Irek, Zvezdin Valery*

Kazan Federal University Naberezhnye Chelny Institute, Naberezhnye Chelny, Russian Federation

Abstract

Comparative analysis of various modes of metal laser processing based on the analysis of acoustic vibrations from the machining area requires interpretation of the original signal which allows revealing the interrelation of the data received with indicators of the parts quality.

The nature of acoustic signal oscillations from the area of laser radiation interaction with the metal is connected with its spectral function of the Fourier transform. This transformation describes the relationship between time and spectral characteristics of the acoustic signals of the same process.

The article describes the method of acoustic oscillations analysis and achieving the comparative parameters in laser heat treatment: duration of the laser radiation pulse, width of signal spectrum, minimum and maximum values of spectrum function, frequency rates of harmonic components, energy of signal. Experimental research and analysis of the data showed that frequency of acoustic signal is weakly dependent on density of laser energy, and change of pulse laser energy density in parts processing directly affects the increase of output signal amplitude.

The revealed dependencies of the signal frequency and amplitude on the energy density correspond to the theoretical research in this direction and allow using the data obtained in the future to automate the control laser machining process.

Peer-review under responsibility of the organizing committee of the international conference on Dynamics and Vibroacoustics of Machines

Keywords: laser radiation, energy density, the Fourier transform, ultrasound, amplitude, frequency, spectrum.

* Corresponding author. Tel.: +7-917-392-5483.
E-mail address: gotoindvdum@gmail.com

Peer-review under responsibility of the organizing committee of the international conference on Dynamics and Vibroacoustics of Machines
doi:10.1016/j.proeng.2017.02.324